

WHAT IS CLAIMED IS:

1. A stacked piezoelectric element comprising a plurality of piezoelectric layers and electrode layers stacked alternately in which said electrode layers are 5 electrically connected by a penetrating electrode formed in a conductive hole formed in a direction of the thickness of said piezoelectric layers;

wherein the penetrating electrode formed in a piezoelectric layer of a second layer is so positioned 10 as to overlap with the penetrating electrode formed in a piezoelectric layer of a first layer in said direction of thickness.

2. A stacked piezoelectric element according to 15 claim 1, wherein the penetrating electrode formed in a piezoelectric layer of a third layer is also so positioned as to overlap with the penetrating electrodes formed in said piezoelectric layers of said first and second layers in said direction of thickness.

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3. A stacked piezoelectric element according to claim 1, wherein said first layer is subjected to surface processing.

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4. A stacked piezoelectric element according to claim 2, wherein surface processing is applied to said second layer by eliminating said first layer.

5. A stacked piezoelectric element formed by stacking and sintering a plurality of piezoelectric layers having an electro-mechanical energy converting function and layers of an electrode material stacked alternately, said element comprising:

a surface electrode layer, which is used for polarization process, made thicker than an internal electrode layer.

10 6. A stacked piezoelectric element formed by stacking and sintering a plurality of piezoelectric layers having an electro-mechanical energy converting function and layers of an electrode material stacked alternately, said element comprising:

15 an electrode layer, which has a conductive circuit function, made thicker than the other internal electrode layer.

20 7. A stacked piezoelectric element formed by stacking and sintering a plurality of piezoelectric layers having an electro-mechanical energy converting function and layers of an electrode material stacked alternately, said element comprising:

25 a surface electrode layer, which is used for polarization process, and an electrode layer, which has a conductive circuit function, made thicker than the other internal electrode layer.

8. A stacked piezoelectric element according to
claim 5, wherein the thickness of said surface
electrode layer used for the polarization process is
selected as 4 to 6 μm in average and that of the
5 internal electrode layer is selected as 2 to 3 μm or
less.

9. A stacked piezoelectric element according to
claim 6, wherein the thickness of the electrode layer
10 having the conductive circuit function is selected as 4
to 6 μm in average and that of other electrode layers
is selected as 2 to 3 μm .

10. A stacked piezoelectric element according to
15 claim 7, wherein the thickness of said surface
electrode layer used for the polarization process is
selected as 4 to 6 μm in average, the thickness of the
electrode layer having the conductive circuit function
is selected as 4 to 6 μm in average and that of other
20 electrode layers is selected as 2 to 3 μm .

11. A stacked piezoelectric element according to
claim 5, wherein a through hole is used for electrical
conduction between the electrode layers.

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12. A stacked piezoelectric element according to
claim 6, wherein a through hole is used for electrical

conduction between the electrode layers.

13. A stacked piezoelectric element according to
claim 7, wherein a through hole is used for electrical
5 conduction between the electrode layers.

14. A stacked piezoelectric element formed by
stacking alternately a plurality of piezoelectric
layers having an electro-mechanical energy converting
10 function and layers of an electrode material and
utilizing a penetrating electrode for electrical
conduction between said layers of the electrode
material, comprising:

15 a reinforcing layer of the electrode material
provided in the junction of said penetrating electrode
and said layer of the electrode material in such a
manner that said layer of the electrode material
becomes thicker in the peripheral portion of said
penetrating electrode than said layer of the electrode
20 material in other portions.

15. A stacked piezoelectric element formed by
stacking alternately a plurality of piezoelectric
layers having an electro-mechanical energy converting
25 function and layers of an electrode material and
utilizing a penetrating electrode for electrical
conduction between said layers of the electrode

material, comprising:

a reinforcing layer of the electrode material provided in the junction of said penetrating electrode and said layer of the electrode material in such a 5 manner that said layer of the electrode material becomes thicker in the junction surface of said penetrating electrode and in the peripheral portion thereof than said layer of the electrode material in other portions.

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16. A stacked piezoelectric element formed by stacking alternately a plurality of piezoelectric layers having an electro-mechanical energy converting function and layers of an electrode material and 15 utilizing a penetrating electrode for electrical conduction between said layers of the electrode material, comprising:

a reinforcing layer of the electrode material provided in the peripheral portion of said penetrating 20 electrode in the junction between said penetrating electrodes.

17. A stacked piezoelectric element according to claim 14, wherein said reinforcing layer of the 25 electrode material is used for connecting said piezoelectric layer having a penetrating electrode of a coincided positional phase to said layer of the

electrode material.

18. A stacked piezoelectric element according to
claim 15, wherein said reinforcing layer of the
5 electrode material is provided in a first layer used
for the polarization process.

19. A stacked piezoelectric element according to
claim 15, wherein said reinforcing layer of the
10 electrode material is used for connecting said
piezoelectric layer having a penetrating electrode of a
non-coincided positional phase to said layer of the
electrode material.

15 20. A method for producing a stacked
piezoelectric element by alternately stacking a
plurality of layers of an electrode material and
piezoelectric layers having an electro-mechanical
energy converting function and provided with a
20 conductive penetrating electrode to be connected with
said layers of electrode material and sintering thus
stacked layers, comprising a step of:

25 forming, on said layer of the electrode material,
a layer of the electrode material by screen printing in
the peripheral portion of the connecting said layer of
the electrode material to said penetrating electrode.

21. A method for producing a stacked piezoelectric element by alternately stacking a plurality of layers of an electrode material and piezoelectric layers having an electro-mechanical 5 energy converting function and provided with a conductive penetrating electrode to be connected with said layers of electrode material and sintering thus stacked layers, comprising a step of:

10 forming, on said layer of the electrode material, a layer of the electrode material by screen printing, at the connecting portion of said layer of the electrode material to said penetrating electrode, on the connecting surface of said penetrating electrode and in the peripheral portion thereof.

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22. A method for producing a stacked piezoelectric element by alternately stacking a plurality of layers of an electrode material and piezoelectric layers having an electro-mechanical 20 energy converting function and provided with a conductive penetrating electrode to be connected with said layers of electrode material and sintering thus stacked layers, comprising a step of:

25 forming a layer of the electrode material by screen printing on said piezoelectric layer in the peripheral portion of the connecting between said penetrating electrodes.